Drowning the Sacred Waters:

The Hydroelectric Flooding of the Angara River and Lake Baikal in the 1950s

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Rough Draft, Work in Progress.

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In July of 1956, the first turbines of the Irkutsk Hydroelectric power station (GES—*Gidroelektrostantsiia*) in eastern Siberia began their work to transform into electricity the gravity-generated energy carried by the water that flowed rapidly along the Angara river from Lake Baikal to the Enisei river [See map below].[1] Humans have lived for thousands of years in intimate, life-sustaining relations with Baikal and its rivers: socially and economically through fishing, hunting, transportation, drinking, and the utilization of other water resources; and religiously Baikal and its rivers (and the geological formations in and around them) offered essential spiritual and religious sites for the peoples of the region, sites where the world of the spirits meets and interacts with the material, physical human world.[2] However, the construction and commissioning of the Irkutsk GES (remaining turbines would come online in the following years) was a landmark moment of profound change in the human-water relationship at Baikal.

In the months leading up to the official launching of the Irkutsk hydroelectric facility, engineers had overseen the blocking of the Angara and the filling up of a reservoir behind the earthen dam (what is now called the Irkutsk Sea, a popular boating destination). The dam caused the flooding of thousands of square kilometers of land upstream on the Angara and

[1] Over 25 million years in age, Lake Baikal is one of the earth's natural wonders. The lake is the world's oldest, deepest, and largest (in terms of volume of water), holding one-fifth of all surface, liquid freshwater on the planet—more water than all the Great Lakes combined. Its unusually pure water and unique ecosystem contains at least 1,500 endemic species, such as the *nerpa*, one of the few freshwater seals on the planet. Baikal was named a UNESCO World Heritage Site in 1996, and long ago came to be viewed as an inseparable component of Russian identity. While there are 330-some rivers that flow into Baikal, the Angara is the only river that Baikal empties out into.

[2] Nicholas Breyfogle, "Sacred Waters: The Spiritual World of Lake Baikal, " unpublished paper presented at the National Convention of the American Association for the Advancement of Slavic Studies, Boston, November 12, 2009.

around Lake Baikal, with the water level rising on the Angara as much as 30 meters in some locations and raising the water level of Baikal about 1-1.5 meters on average. The rising waters unleashed extensive transformations on both the river-lake system and on the lives of the Buriat, Evenk, and Russian peoples who inhabited their shores. Indeed, this human-induced, hydroelectric flooding dramatically transformed the hydrological and ecological systems (especially fish and human ecologies) of the Baikal-Angara system, energy flows, and cultural practices (especially religious) of the diverse peoples of the region. Whole communities found their villages drowned, water transport and fishing infrastructure disappeared, the shoreline was irrevocably changed, and the spawning grounds for the lake's endemic (and iconic) fish, the omul, were sabotaged. Perhaps even more importantly, the Shamanist Buriat and Evenk communities found many of their religious sites dropped underwater, and struggled to prevent (and then culturally to absorb) the loss of these sacred sites. The flooding altered the human cultural relationship with nature in the area. The emotional, spiritual, and familial ties to specific locations and lands were severed and the memories colored by the flooding. Cycles/Rhythms of human-environment interactions that had existed for generations were broken. And, in the process, these changes in at the heart of the human-environment nexus later helped to initiate a nature preservation movement focused on Baikal.

Moreover, the reconfiguration and repurposing of the water's energy to electricity then permitted humans rapidly to transform the region into an industrial center that would expand efforts at resource extraction and processing. The building of the GES was in many respects a source of power in search of demand, however. There was no preexisting industrial center in the Irkutsk region that was in need of more power. Rather, engineers and other scientists realized the remarkable power-producing capacity of the Angara and, as a result, felt it would be

a shame not to harness that power. Once the dam and the GES were built, then there was an effort to increase industry and other human demand for this electricity.[3] Notably, the benefits and problems of electricity were not shared equally among the different peoples of the region (diverging based often on ethnicity and spatial location of habitation).

Given the rapid proliferation of hydroelectric dams in the 20th and 21st centuries, the experience and practices of hydroelectric flooding offers an immediately comparative trans-national and cross-cultural human experience.[4] Indeed, the flooding of the Angara River, Lake Baikal, and surrounding lands that resulted from the building of the Irkutsk GES allows us to contemplate the meanings and outcomes of anthropogenic flooding and changes in water ecologies. It is common these days to hear the idea that there are no "natural" disasters, and the case of hydroelectric flooding is a clear example. Unlike "natural" floods—that often come quickly and without warning or follow cyclical, annual cycles—the floods of the Irkutsk GES were neither unexpected nor quick, but rather human-made and enduring transformations that were actuated both deliberately and deliberatively. The inhabitants of the affected region were given time to prepare and the regional leadership had been planning this process for years (from removing people and animals, to extracting all the timber and other resources they could, to cleaning shorelines of refuse and toxins). Local inhabitants knew the waters were coming, had studied the potential impact of the raising waters at length, and had prepared the lands that would be submerged. When the waters rose they came slowly, and the river backed up from the closing of its flow at the Irkutsk dam. Flooding is a subjective term, reflecting the belief on the

[3] In this way, the development of hydroelectric power in the Irkutsk region is not dissimilar to what Richard White has noted regarding hydroelectric development on the Columbia River. *The Organic Machine*.

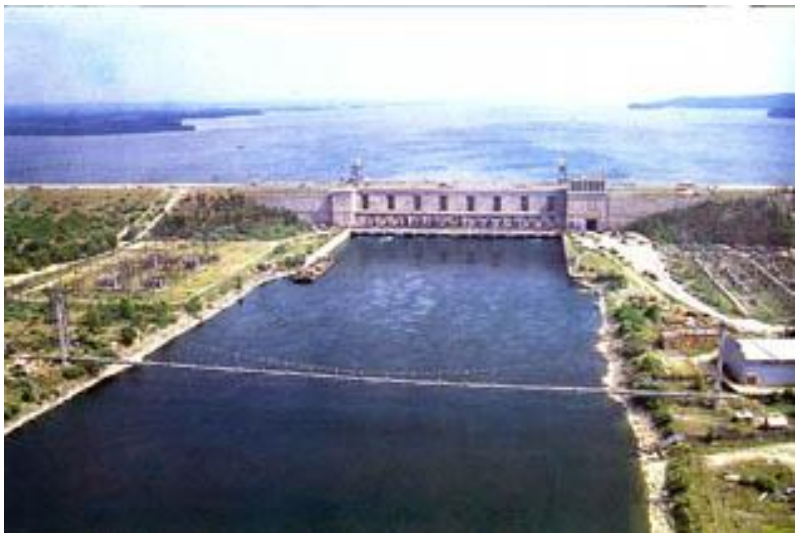
[4] For a few examples, see JR McNeill, *Something New Under the Sun*; Donald Worster, *Rivers of Empire*; Richard White, *The Organic Machine*; Mark Reisner, *Cadillac Desert*; and Matthew Evenden, *Fish versus Power: An Environmental History of the Fraser River*.

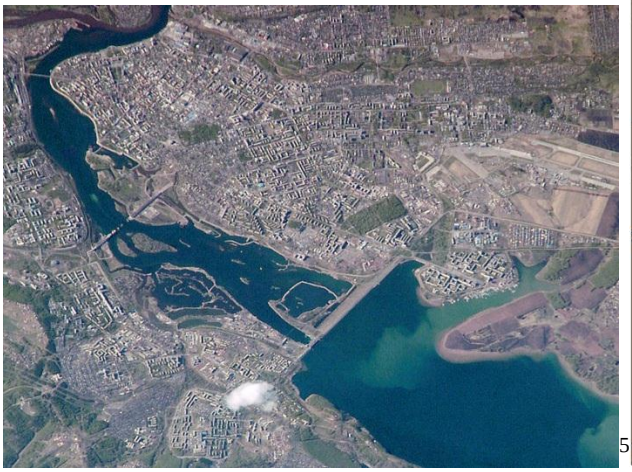
part of particular communities that they have too much water at a given moment in time. For the people of the Angara-Baikal region, there were many who welcomed the rising waters as a sign of progress and opportunity; for whom the term "flood" would be misapplied and the deep waters welcomed. Others, however, saw the oncoming waters as a terrifying flood and lamented its destruction and life-altering consequences.

The flooding that the Irkutsk GES caused was qualitatively different from the episodic flooding that affected the Baikal region historically. Floods were not uncommon to the Baikal-Angara region, resulting both from seismic activity and also periodic high rains or winter melts. In Irkutsk itself, the breakup of the ice each year threatened floods to the city as chunks of ice smashed and crashed together, redirecting the river overland and through people's homes (a common enough process to have its own name, *shuga*). Perhaps the most dramatic and memorialized flood took place on New Year's eve 1861-62, when a massive earthquake in the center of Baikal unleashed a tsunami that shot across the lake and exploded over the low-lying Tsagan Steppe on the eastern side of the lake. Some 200 km^2 were permanently submerged under the waters of Baikal in the process—in what is now aptly known as "Collapse" Bay—along with some five villages and tens of thousands of livestock.

The paper explores four aspects of the damming and drowning process: 1) the decision to build the GES; 2) the efforts to prepare the land, flora, and fauna of the flood zone, moving humans, animals, and all sorts of physical objects out; 3) the outcomes of the GES for fish and human communities; and 4) the rise of an environmental protection movement around Baikal in response to the hydroelectric development projects. In examining these four topics, the paper approaches the damming and flooding process as an interactive, integrated system in which the intersections of i) the geological, hydrological, and biological processes of the river and lake, ii)

the social and cultural (especially ethno-religious) systems of the humans in the region; and iii) the technological structures and schemes of Soviet engineers and urban planners combined to produce a variety of dramatic, contested results in the damming and flooding process—with each of these actants affecting the process in its own important way.





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[5] http://www.irkutskenergo.ru/asp/photoAlbumCard.aspx?noparma=ziwk&Gid=103.2

I. Origins: The Plans for the Irkutsk GES

The decision to build the Irkutsk GES was many decades in the making, and reflected a larger effort to make use of the Angara and Enisei rivers to produce electricity. For years in advance, engineers and other scientists consciously explored the region and its possibilities. This was not simply a case of planners plopping down hydroelectric dams without regard for the geological and hydrological realities with which they came into contact—as Soviet hydroengineering is often described. In this exploration, the engineers and planners adapted and evolved their relationship with the natural world. Throughout the process of planning (and ultimately the decision to develop hydroelectric power at all) reflected the influence of the physical characteristics of Lake Baikal and the Angara River. Here, building on the ideas of Actor Network Theory (ANT) and Thing Theory, we should understand the waters, rocks, and species of Baikal-Angara as forces, essences, actants that in differing measures intersected with the understandings, aspirations, and socio-economic-political needs and desires of humans to produce the Irkutsk GES in the way that it was produced from the multitudes of other possible outcomes.[6]

Russians had long eyed the electrical potential of the Angara river and the Baikal-Angara-Enisei water system. One of the first scientists to remark on the electricity-generating potential of the Angara was B. I. Dybowski, who already in the 1870s remarked "The power of

[6] B. Brown, "Thing Theory," in B. Brown, ed., *Things*. (Chicago, 2004); T. Dant, *Materiality and Society*. (Maidenhead, 2005); B. Latour, *Reassembling the Social*; and W. Tisseron, *Comment l'esprit vient aux objects* (Paris, 1999).

the Angara, transformed in electric motors, will play an important role in the development of the economy of the country." [7] After WWI and the assertion of Soviet power in the early 1920s, economic development continued slowly in the Irkutsk region. Projects concerning the hydroelectric development of the Angara did not move beyond the discussion stage at this point, however, because the projects were considered far too expensive and technically difficult. Through the 1920s and 1930s, engineers and scientists worked to gather information and prepare for the building of a hydroelectric system on the river—indeed no less than Lenin himself had indicated the importance of electrical development in the area.[8] After the work of A.A. Vel'ner in 1920 on the possibilities of the Angara, the first sustained feasibility study and detailed plan was completed 1930-1935 by V. M. Malyshev, who did a wide-scale examination of the problems and possibilities of development in the area. He followed a series of fundamental principles that guided the process for decades afterward: "complete utilization of the drop of the Angara and creation on it of a continuous cascade of hydro power installations; maximum regulation of the flow; to whatever extent was technically feasible and economic, maximum concentration of heads at different stages."[9]

However, after WWII, the pace of development throughout Siberia took off spectacularly as Siberia became a focus of economic development under Khrushchev and Brezhnev. In the 1950s alone, the industrial production of Irkutsk oblast (on Baikal's western shore) grew over 40 times.[10] Indeed at the 1956 party congress, Nikita Khrushchev announced that the development

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[7] Galazii, *Put' Poznaniia*, 275.
[8] Galazii, ed., *Put' Poznaniia*.
[9] D. M. Yurinov, ed., *Water Power and Construction of Complex Hydraulic Works during Fifty Years of Soviet Rule*. P. 324.
[10] Josephson, p. 167 [from Bando]

of Siberia was to be crucial to the future success of the Soviet Union.[11] Khrushchev, and Brezhnev after him, wanted to utilize the great natural wealth and resources of Siberia in order to push Soviet development forward for three primary reasons: 1) to rebuild the Soviet economy in the wake of the devastation of WWII, and esp. to shift the locus of industrial development from the west (which had been overrun during war) to the east where distance would protect it should the West invade again; 2) to bring the USSR to par with the Americans on an economic level within a matter of years to compete in the Cold War; and 3) to utilize the vast, and as yet untapped resources (water, mineral, oil, gas, timber, electricity, etc.) of eastern Siberia to achieve these goals. In particular, Soviet economic development programs at this time thought "big" and in terms of large-scale enterprises—usually termed Soviet gigantomania (although the USSR looks little different from any number of other countries and peoples across the globe during the post-war, Cold-war era)[12]. This approach is witnessed in the "taming" of Siberia's rivers in massive hydroelectric stations—most notably the series of hydroelectric stations along the Angara and Enisei rivers—that would generate vast amounts of power to support a rapid increase in factories and industrial enterprises in the region; the development of large-scale oil and gas fields, and later the BAM project and the proposed river diversion projects. In the process, they would transform the environment for the "benefits of the motherland." [13] This was a time when slogans like "We will conquer you, Angara" elicited genuine enthusiasm not jaded, ironic sighs.[14]

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[11] 20th party congress.
[12] Josephson, *Industrialized Nature*; McNeill and Unger, *Environmental Histories of the Cold War*; McNeill, *Something New under the Sun*.
[13] Josephson, *Akademgorodok*, p. 169; Lincoln, *Conquest of a Continent*.
[14] Sergeev, 50-51.

Interest in tapping the Angara for hydroelectric power derived not only from the human desire for power to drive machines an industrial economy as quickly and extensively as possible, but also from the material characteristics of the rivers and lake themselves. As many observers knew, the Angara and Enisei river system together represented the largest in Russia/Soviet Union in terms of flow and "as objects of power exploitation they occupy first place among hydro resources." Lake Baikal sits almost half a kilometer above the Arctic Ocean, and the potential power production from such a drop as the water courses from one to the other along the Angara and Enisei was a dizzying prospect for hydroengineers. At the same time, the regulating effects of Lake Baikal ensured that it would relatively uncomplicated to ensure a uniform flow of water through whatever hydroelectric systems were put in place. "Thanks to the controlling influence of Baikal the maximum discharge at the sources of the Angara exceeds the minimum about six times in all, whereas on the Kama near Perm this ratio is more than 100, in the Dnieper near Zaporozh'e it is more than 200 and on the Oka near Kaluga it is more than 300." And, in addition, geologists were quick to point out that the river beds themselves were excellent for dam building, with narrow gorges and firm rock foundations, which permit the "impounding of large heads with a relatively small volume of construction works and capital expenditure." The results would be extremely cheap electric power, with costs about half of the building of hydroelectricity on the Volga river.[15]

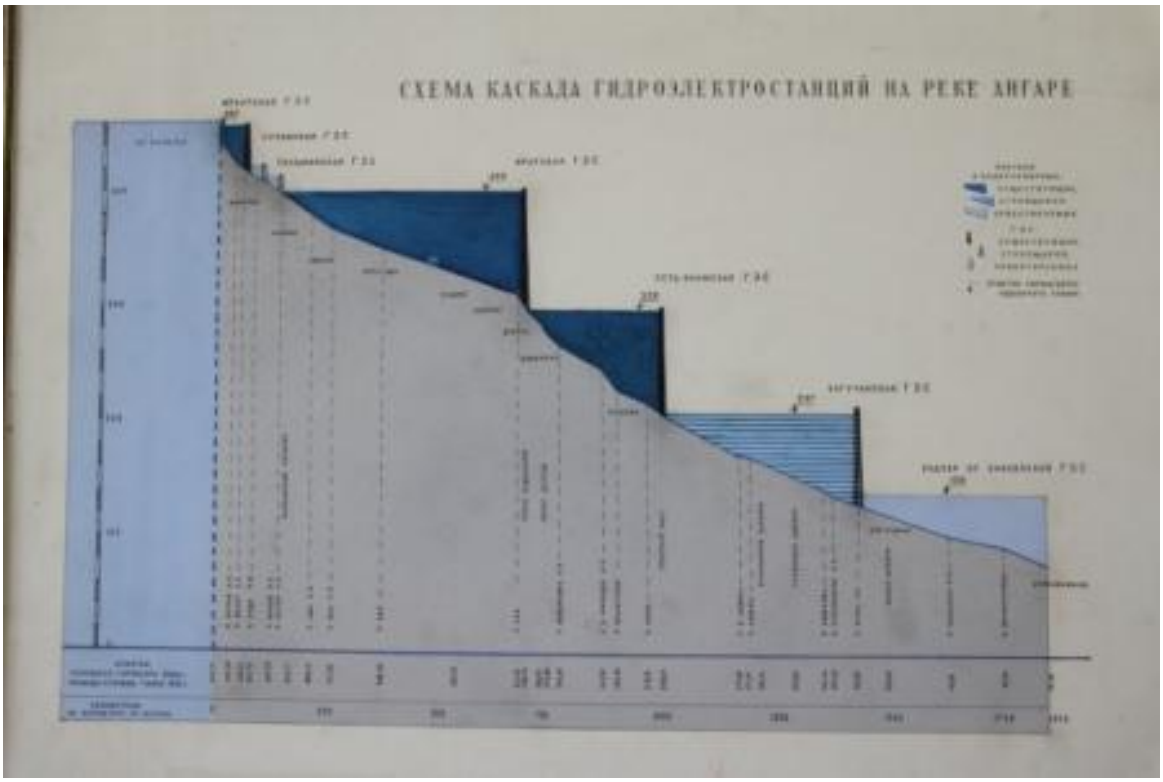
To take full advantage of the electric potential of the Baikal-Angara-Enisei system, engineers planned for a multi-stage cascade of hydroelectric power plants. There were initially 6 in the 1935 plan, stretched out along the Angara river, and then a whole new series on the

[15] S. N. Moiseev, *Stroitel'stvo Irkutskoi GES na Angare* (Moscow and Leningrad, 1959); 7-16; I. N. Ivanov, *Gidroenergetika Angary i prirodnaia sreda* (1991); Yurinov, 321, 323; Anne Rassweiler, *The Generation of Power: The History of Dneprstroi;* and John Johnson, "Volgograd GES."

Enisei. However, as the engineers came upon areas that showed well-developed karst phenomena both on the riverbed and the Angara's banks, which would likely cause complications in the building process, they realized they would need to develop the hydroelectric system in different ways. Here then the karst phenomena directly affected the locations of the dams, indicated which lands would be flooded, and dictated which human communities would be sent into upheaval through inundation.

In the end, then, the geological and hydrological structures of the Baikal-Angara-Enisei water system themselves determined in important ways how the rivers would be transformed and cut up by human aspirations for electricity. The final plans, developed in 1953, would begin with the Irkutsk dam, include another five, and a major dam and reservoir at Bratsk. Of all these, the Irkutsk dam had perhaps the greatest impact on Lake Baikal, as the first dam to pool the Angara's water behind it. At the same time, the Irkutsk GES was a crucial tool in the regulation of water running through the whole system.[16]

[16] The creation of several large reservoirs along the cascade would, engineers were quick to note, allow for the passage of boats of larger draft across parts of the river that had been unusual previously for water transport. Thus, the reformulation of the Baikal-Angara-Enisei system would have both electricity and transport as its results.



The hydroelectric cascade on the Angara river. [17]

[17] Baikal Museum (Listvianka, Russia), photo by author.

II. Preparing the Land

In the years leading up to the opening of the Irkutsk GES for electrical production (and the closing of the Angara to allow for the filling up of the reservoir), local officials worked at great length to document and determine what parts of the land along the Angara and around Lake Baikal would be dropped underwater in order to prepare those lands, and the people who then lived on them, for the new water-level realities. They worked to move the hundreds of villages and thousands of people to new sites and new homes. They strove to remove from the coming waters any useful buildings, building materials, crops, animals, and any other resources of use to human communities. The goals of these preparations were several: to make sure that the people in the flooding zones were safe and well taken care of; that no resources and economic structures were not unnecessarily lost under the water; to ensure no disruption in economic activities and production on the part of the population; and to avert in all cases possible the pollution of the lake through waste and toxins infiltrating the water from the submerged lands. The task was enormous. 138,600 hectares of land were in the flooding zone, including 32,300 hectares of agricultural land, numerous fishing villages, docks, and wharves, and more than 200 settlements with some 17,000 people were resettled and moved—not to mention manufactories, schools, medical facilities, hunting sites, and so much else. The Irkutsk-Listvianka highway and the Irkutsk-Podorvikha-Baikal railway line were also in the flooding zone. The latter railway line was a crucial part of the Trans-Siberian railway, and so a replacement needed to be built as quickly as possible to avoid interruptions of transportation to the Soviet Far East.[18] The process

[18] http://www.obaykale.ru/baykal-obshie-dannye_05_1.htm; and http://en.irkutskenergo.ru/qa/1008.2.html. See also *Dinamiki beregov*.

cost millions of rubles.[19] Here, in all these preparations, we can see clearly many of the differences between "natural" and cyclical floods and hydroelectric flooding.

Local Soviet planners took great pains to plan the movement of people and materials—and offered a precise and often unattainable timeline, with all of the steps completed in advance of the drowning.[20] And these meticulous calculations reflected a bureaucratic and accounting approach to nature that counted the physical world as material units rather than ecologies, geologies, and ecosystems. Trees were to be cut down in the zones, and transported away. The roots and stumps of the trees were to be removed, or the stumps cut to specific heights depending on how deep in the water the site of the former tree was likely to be, all calculated to the nearest centimeter: roots had to be at least 15 cm below the ground level if submerged in water of more than 7 meters, and no less than 25 cm below the soil level in shallower water. All leftover straw, manure, wood, and other construction material were to be burned. Scrap metal was to be taken from the flood zone, and, if not, then buried to a certain depth depending on the projected water depth. For manure that did not burn because it was too damp, workers were required to break it up into pieces of no more than 10 cm across and then throw and scatter the manure in very shallow layers across the land so that it will quickly join with the soil; and this manure preparation was to be done at least a year in advance of the flooding. The remains of leather factories, slaughterhouses, the holding pens of collective farms were to be sanitized with chlorine. Wells, ice houses, basements, vegetable storage areas were to be filled in and covered

[19] There is no total cost for all the moving and preparation readily available in the sources. I am working to add up the different amounts I find in different archival files. See, for example, NARB f. R-195, op. 13, d. 978, l. 4.

[20] I draw the following discussion from a series of state reports and rules on the process now found in the National Archives of the Buriat Republic (Ulan-Ude, Russia) [Natsional'nyi arkhiv Buriatskoi respubliki; hereafter NARB] fond R-195 (Gosudarstvennyi planovyi komitet Buriatskoi ASSR), opis' 13, dela 819, 820, 821, 959, 978, 1081a

with earth and stones. There was a small window in which families could come and remove bodies from the cemeteries to be flooded, but once that window was shut, the bodies were to remain in the ground, to be covered by water. All crosses and any other markers (whether of stone or wood) were to taken down and removed. The list of detailed actions takes up hundreds of pages in the archives. [21]

The process of preparation was so detailed, careful, and attentive that we should also understand it as something not just physical but spiritual and ritualized: in many respects an effort to say goodbye to these lands and to offer them a proper funeral/burial. Valentin Rasputin, in *Farewell to Matyora* (which is his fictionalized memoir based on his own experiences growing up in a village on the Angara that was flooded, displacing him and his family) compares and parallels the process of preparing a body for a funeral and the efforts to prepare villages and their lands for flooding. Just as people prepare the bodies for burial, saying prayers and telling stories about their lives, so too did the villagers clean, dress, pray for, and tell stories about their soon-to-be underwater homes, lands, and places.[22] As Rasputin writes:

> Whitewashing the house was considered a preholiday event: they whitewashed twice a year—after the autumn harvest before Intercession and after the winter heating for Easter…. But she wouldn't be preparing the house for the holiday now…. You don't put a person in his coffin without washing him and dressing him in his best—that was the custom. So how could she send off her won house out of which her father and mother, grandfather and grandmother, were carried and in which she had

[21] NARB f. R-195, op. 13, d. 820, ll. 52-62, for instance.
[22] *Farewell to Matyora*. I am in the process of gathering oral history from several elderly Buriats who were part of the resettlement process in an effort to understand more fully the meanings for the humans of the flooding.

> spent her entire life, except for what was left, and deny it the same dressing up?[23]

The process of moving the population, and then "sanitizing" and "cleaning" the soon-to-be flooded lands did not proceed well or quickly.[24] In part, the slowdowns were a function of the exacting and excruciating detail in which the process was to be carried out. But, in part, this slow process reflected a disinterest or reluctance on the part of the population to accept their fate and a refusal, at times, to move from places and homes that had served them and their families for generations. Villagers in the future flood zone called themselves the "drowned" even before the waters began to rise, and this was a label that stayed with them for years after they moved to a new location.[25]

The reluctance was in some cases made worse by the fact that—in a version of what Mark Carey calls "disaster economics"[26]—the authorities at times used the flooding as a way to break families and communities from old, rural, village lifestyles and to try to move them to ostensibly more modern, happier, and productive lives in towns or larger settlements (and to shift their ways of making a living from agricultural or hunting/fishing ventures to mechanical production or service activities. Here, the Soviets could push not only technological and economic modernization through hydroelectricity, but also cultural and social modernization of the humans involved as well. In this way, the imposition of the hydroelectric flooding on these communities forced them to confront a double dislocation: from their traditional homes, and from their traditional lifestyles and lifeways. Rasputin offers an insightful exploration of the ways in which different people in a village responded to coming flooding. Many simply moved

[23] Rasputin, *Farewell to Matyora*, 190-191.
[24] NARB f. R-195, op. 13, d. 821, for eg.
[25] Rasputin, *Farewell to Matyora*, 201.
[26] Carey, *In the Shadow of Melting Glaciers*.

off to their new homes as told, although often not happily. Others struggled profoundly with the forced movement and forced assimilation into a more modern, urban way of life.

> This last, crucial year seemed terrifying. And what seemed particularly terrible and unfair was that the year moved on in its usual way and the days with their usual speed got closer to the that which would be, and there was no way to hold back what would be. Later, when it was all over and they were in the new life and they would see what they would be….once they harnessed themselves into this new life and pulled, it would probably become easier for them, but for now everything ahead frightened them, everything seemed strange and unsteady…[27]

And all of the preparations of the land elicited a great deal of thought and discussion about the human-nature relationship across generations and the meanings of human existence on this planet.

> -- "Why are you behaving like this? Does this land belong to you alone? We're all here today and gone tomorrow. We're all like migratory birds. This land belongs to everyone—those who were here before us and those who will come after. We're only on it for a tiny time… And we were given Matyora only to take care of …. To treat it well and be fed by it. And what have you done with it? Your elders entrusted you with it so that you would spend your life on it and pass it on to the younger ones. And they'll come asking for it. …"
>
> -- "Man is king of nature," Andrei prompted.
>
> -- "Yes, yes, king. Just reign a bit and you'll be sorry."[28]

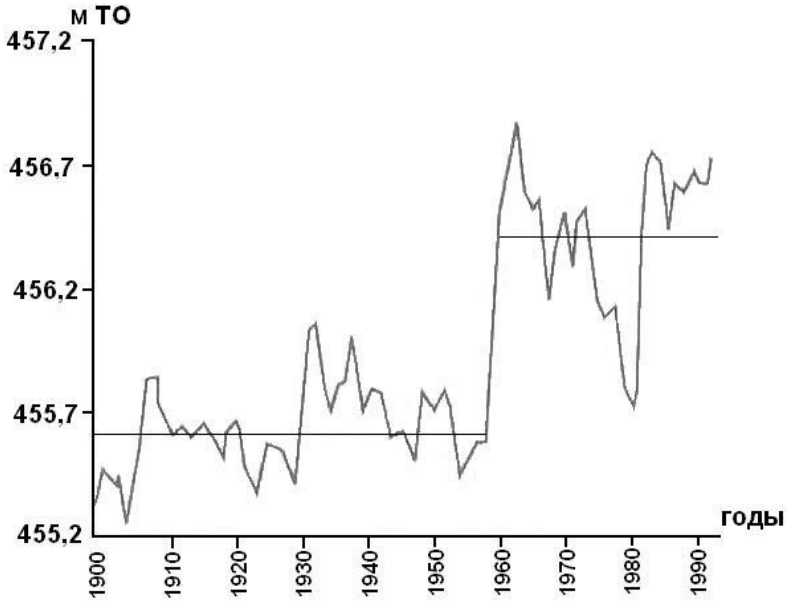
[27] Rasputin, *Farewell to Matyora*, 46.
[28] Rasputin, *Farewell to Matyora*, 119-120.

III. Transforming Ecologies

1) The Fate of Fish and other Fauna

The building of the Irkutsk GES, and the rising of the level of the water around Lake Baikal had a dramatic impact on the fish populations of the lake—especially on the omul (*Coregonus migratorius*), an endemic species and one of the most important commercial and food fish in the lake for generations. As the graph below indicates, the level of the water in the lake increased, on average, in the range of between 1-1.5 meters after the Irkutsk GES was set in operation. At the same time, the closely monitored regulation of the water level for hydroelectric purposes resulted in changes in the amplitude of the annual ups and downs of the water level in the lake. And scientists have noted certain changes to the water temperature regime in the in-shore zones. [29] With a lake the size of Baikal (more than 31,000 km^2, more than one kilometer at its deepest point, and more than 2,100 km of shoreline), an increase in water level of such magnitude involves a tremendous amount of water.

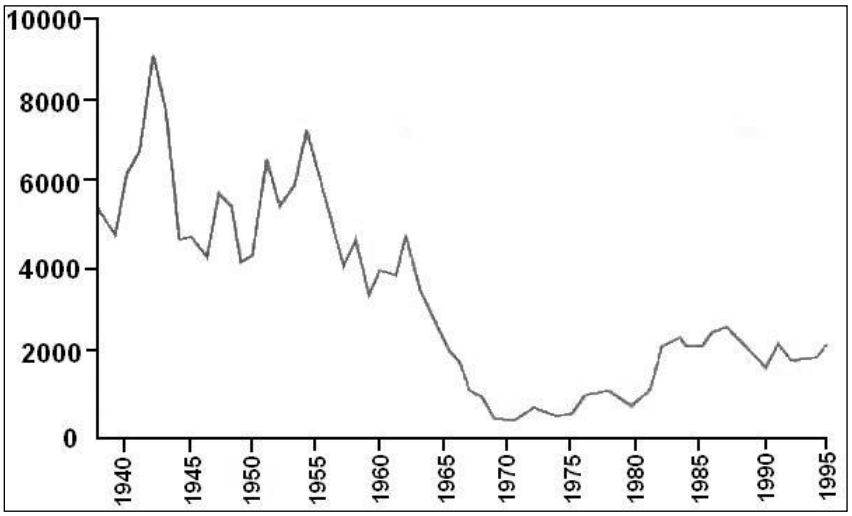
[29] Graph is from T. P. Kalikhman, "Adaptsiia ekosistem iuga ozera Baikal k antropogennym vozdeistiiam," *Global'nye i regional'nye osobennosti transformatsii ekosistem Baikal'skogo raiona* (Ulan Bator, 2008). See also *Dinamika beregov ozera Baikal pri novom urovennom rezhime* (Moscow, 1978). Josephson, *Akademgorodok,* 179; Galazii, *Put',* p. 282-284; Zlobin, p. 77.



Average level of water in Lake Baikal in the period before (1899-1958) and after (1959-1994) the regulation of the water level by the Irkutsk GES.

The larger effect of this change in water level on the omul fish population was nothing short of dramatic. Along with marked washing out of the shores and embankments of the lake, observers noted a displacement of the food base for fish and the degradation and flooding of the spawning grounds. The fish were neither able to spawn as they had done before nor could they find sufficient food to eat. The size of omul dropped noticeably between 1965 and 1975: with the average weight of a fish decreasing from 300 grams to 100-150 grams. In part, this decrease in weight seems to be connected to a marked drop in the foods available to the pelagic fish. In one study, comparing the period 1966-67 with 1973-75, the authors found that the degree of food available for fish dropped by 42% (including a drop in the copepod *epishura baikalensis).* And, a 1972 study concluded that 3,250 metric tonnes were lost annually in the fish catch because of

the rise in water level in Baikal from the Irkutsk GES. The drop in the size of the omul catch can be seen in the graph below.[30]



Changes to size of omul catch, with massive drop beginning just after the commissioning of the Irkutsk GES.

There were other changes to the fauna. Engineers discovered that the construction of the hydroelectric stations along the Angara had eliminated a species they considered "pests", the *gnusy* (mites) that swarmed the region. What the spraying of vast amounts of chemicals such as DDT, often with fans, could not accomplish, the raising of the water level behind the dam had achieved. In its unaltered form, Baikal kept an even flow and level of clean water coming down the Angara—a perfect habitat for the mites. With the dams erected for the hydro plants, the flow

[30] On fish, see Kalikhman, "Adaptsiia;" Atutov et al, eds, *Gidroenergetika i sostoianie ekosistemy ozera Baikal* (1999); *Ryby ozera Baikal i ego basseina* (Ulan Ude, 2007); S. G. Maistrenko and M. A. Maistrenko, "Mnogoletniaia dinamika osnovnykh biologicherskikh pokazatelei morfekologicheskikh grupp baikla'skogo omulia (Coregonus autumnalis migratoriius Georgi)," *Sibirskii ekologicheskii zhurnal* 5 (1998): 417-422; *Ryby i rybnoe khoziaistvo v basseine ozera Baikal* (Irkutsk, 1958); and Izrael i Anokhin, eds, *Monitoring sostoianiia ozera Baikal.*

of water was changed and not only was vast amounts of power created but the mites were destroyed, making life all the better for the population.[31]

2) Human Outcomes

The transformation of human life from the flooding was also significant. With 500 km^2 of land flooded as a result of the Irkutsk GES, whole communities were relocated from places that in many cases had significant familial and personal meaning and they were broken from their traditional ways of life.

At the same time, hydroelectricity made possible massive industrialization—particularly in heat-intensive industrial processes, work with aluminum, titanium, magnesium, ferroalloys and power-intensive chemical products, and timber work. These industrial activities created air pollution that tended to settle in Lake Baikal, not to mention other sorts of pollutants that were discharged into the watershed as waste products from the industrial processes (especially from the two cellulose plants at Baikal'sk and Selenginsk that were built in the 1960s). And later, electricity became a cash crop for the region in sales within Russia and at times abroad. Importantly, these industrial enterprises and factories were an outcome (not the cause) of the hydroelectrification of the region. That is, Soviet planners built the power source first in a region where they felt the potential for bountiful and cheap power was unusually good, and, once they had the power sources in place, then they worked to build the industrial production infrastructure that could then utilize and fully harness these new sources of power.

Human access to the "benefits" of this electricity was not equally distributed to the people of the region; nor was the burden shared equally when it came to transforming the rivers

[31] Josephson, *Akademgorodok*, 168.

and lake. The inhabitants of Irkutsk and Irkutsk oblast received by far the majority of the electricity—and Irkutsk to this day has comparatively inexpensive electricity. At the same time, the building of the dam, flooding of the Angara (and the creation of the Irkutsk Sea), and the regulation of the flow of the river for hydroelectric purposes brought an end to the regular flooding that the people of Irkutsk experienced from the Angara. Here, one type of flooding (large-scale, human organized, prepared, and managed) was substituted for a different type of flooding (regular yet unpredictable and uncontrollable, causing annual damage). Historian Mark Soderstom has described these, usually winter, floods in graphic terms (here describing the early 19th century).

> Such intense frosts exacerbated the near-annual flooding of Irkutsk's main river, the Angara. The unusually fast current of the Angara—the only river to empty Lake Baikal, the world's largest lake—inundated the town with scores of giant ice floes from Baikal (*shuga*, as Irkutians called them). These often obstructed the river at the sharp bend at which Irkutsk was located and jeopardized its poorly maintained wooden embankment. When the Siberian Governor-General requested funds in 1814 to repair the latter, he warned that, without a major reconstruction, the Angara might break through and "make itself a new channel right through the center of town."[32]

The new water regime of the Irkutsk dam not only slowed the flow of the Angara's water made its way through the town, but also significantly affected the process of ice formation on the river and the reservoir. Indeed, scientists were initially surprised to discover that ice tended to form in the reservoir not on top of the water, as is generally the case, but at the bottom of the river bed and along its sides. They also found the breakup of the ice and the movement of *shuga* (ice floes down the river) fundamentally changed by the dam—taking away the longstanding

[32] Soderstrom, "Enlightening the Land of Midnight," 184. See also Galzaii, Put' poznaniia," 281.

flooding and ice-floe threat.[33] As one author described the saving grace of the Irkutsk GES when it came to ending the seriousness of earlier floods:

> The last great flood here took place in 1952. The houses and the streets near the riverbanks were flooded with water. Only with great difficulty and with the help of military technology—armored troop carriers and tank—were they able to save the people, sitting on the roofs and finding themselves captives of the ice that had flooded their homes.[34]

In contrast, if Irkutsk and the western side of the lake benefited, it was the communities on the eastern and northern parts of the lake who drew the short hydroelectric straw. The western and eastern sides of the lakes are characterized by very different geological features and contours. The west has shear, dramatic cliffs and drop offs on the east. The east is defined by much flatter, low-lying beach areas, deltas, and wetlands. Thus, because of the differences in geological formations, it was the peoples of the eastern side of the lake, with a larger Buriat and Evenk populations who saw more of their land and traditional fishing locations go underwater.

Most importantly, the rising waters affected many Buriat and Evenk religious sites around Lake Baikal and the Angara. None more so than the famous Shaman's Rock, a large rock eruption that stands at the point where Baikal empties and the Angara river begins. According to Buriat traditions, the Rock has spiritual origins. The master spirit of Baikal had 330-some sons and only one daughter—the beautiful and intelligent Angara—who he loved very much. She had many suitors, but only the dashing Enisei captured her heart. When Irkut came to ask for Angara's hand in marriage, the Baikal spirit was much swayed and agreed, despite Angara's objections. Days later, Angara made a run for it to join her loved one, Enisei. When he realized what was going on, the Baikal spirit hurled a massive rock after her in an effort to

[33] On the changes in ice development and flow, see Galzaii, Put' poznaniia," 279-281.
[34] Galzaii, Put' poznaniia," 281.

block her way, but the rock landed behind her at the edge of Baikal. Angara kept going and married Enisei, never again to return to Baikal, and the rock remained in place at the mouth of the Angara River. For centuries, the Rock served as a sacred site that humans used to judge the guilt/innocence of an individual. Those suspected of a crime were taken out to the barren Rock and left overnight above the swirling, rushing water. There, the spirits would judge the accused and if innocent, he would be found alive on the Rock the next day. If guilty, he would be sucked into the river never to be seen again. [35]

The flooding from the Irkutsk GES all but submerged this sacred site, with only its very tip sticking out above the waterline today. The spiritual uses of the rock—particularly the way that this place was understood as a crucial opening, or conduit, between the material and spiritual worlds—were now lost for the first time in generations. Few in the Soviet era publicly mourned the loss, and only beginning in the 1970s were public voices heard lamenting the loss of this irreplaceable sacred site.[36]

IV. Asking ever more from the Angara (and the Environmentalist Push Back)

"How lovely the glow of Siberia's electricity must look from outer space, from which you can't see its gaping wounds!"—Valentin Rasputin[37]

When biologist M.M. Kozhov, a highly respected fish and mollusk specialist, took the podium at the Conference on the Development of Productive Forces of Eastern Siberia in Irkutsk

[35] Mark Sergeev, *The Wonders and Problems of Lake Baikal*, 18-19; Brummond, 69-70; and "Angara, Daughter of Baikal."
[36] Zlobin, 76.
[37] *Siberia, Siberia*, 368.

in August of 1958, he had little idea that his speech would spark a new stage in Russian efforts to shield Lake Baikal and its surroundings from the effects of human activity—indeed, that it would spark one of the most visible and successful environmental protection movements in the post-WWII era of Soviet history. The much publicized conference brought together more than 2,000 scientists and scholars from eastern Siberian, and many hundreds more from Moscow, Leningrad, Novosibirsk, Kazakhstan, and Ukraine. After months of regional meetings, commissions, and planning sessions, the specialists met to develop a 10-15 year plan for the rapid industrial development and resource exploitation of eastern Siberia. The town was abuzz with excitement and possibility; Eastern Siberia, local residents proudly knew, was going to be a key to the building of socialism. Hotel rooms could not be found.[38]

At the conference, Kozhov left aside his planned speech on the unsustainable depletion of fish stocks and spoke in opposition to a proposal by N.A. Grigorovich—chief engineer of the Angara sector of the Moscow branch of Gidroproekt—that was designed to dramatically enhance the hydroelectric potential of the region. Grigorovich was charged with maximizing electrical production in this "goldmine" region, and he felt that the already massive hydroelectric undertaking was not producing all the power that it might. Grigorovich noted that a significant amount of potential power was lost because the outflow of water from Baikal to the Angara was sluggish. The flow of water from Baikal to the Angara had for generations been a torrent. As one author describes: "The waters ran from all sides into this aperture. The waves overran one another, collided, stretched out into taut muscular spurts, met in a point somewhere in the middle of the aperture and rushed torrentially over the edge …." However, the construction of the

[38] On the conference, see Zlobin, esp. 13-31, 74-96, passim; Oshchie voprosy razvitiia proizvoditel'nykh sil (Moscow, 1960); and the regular articles from May 1958 on in, for instance, *Sovetskaia Rossiia* and *Buriat-Mongol'skaia Pravda*.

Irkutsk Hydropower station had raised up the waters of the Angara approximately 30 meters behind its walls to the level of Baikal. Instead of the previous rush of water from the lake into the river, now the lake water moved leisurely into what is now called the Irkutsk Sea.[39]

In a daring (lunatic, in fact) solution, Grigorovich suggested detonating 30,000 tons of explosives at the mouth of the Angara in order to widen and deepen the outflow of water from Baikal. (Hiroshima, by way of comparison, was the equivalent of 20,000 tons.) On the basis of extensive, if impossibly precise calculations (for instance, detailing the landing pattern of the rock jettisoned from the detonation), he estimated that the explosion would make the opening 25 meters wider and 100 meters deeper over a distance of 10 km. The rush of water out—which would last four full years until the level of Baikal and the Angara evened out—would then be harnessed by the hydroelectric stations down river, creating billions of kilowatt hours of power. In the process, the lake's level would drop an estimated 5 meters, but for Grigorovich the depth of the lake was a less-than-consequential outcome given the millions of gallons of water that would be released to power Soviet development (what was 5 meters in a lake that was approximately 1.6 km deep at its deepest point?). As Grigorovich argued:

> "In every meter of Baikal water there is energy, which will manifest itself in a huge number: 20 billion kw/h. The carrying out of the explosion and the increasing of the amplitude of the oscillation of the water-level of Baikal will create unique conditions for energy exploitation of the hydroelectric stations on the Angara and Enisei. We should take from Baikal not only its fish, not only its beauty, but also its power. It is necessary for the country……" [40]

[39] Zlobin, 76.
[40] Zlobin, "na Sibirskoi," 133.

Mild-mannered and scientific, Kozhov had earned an undeserved reputation as a "wrecker" for his opposition to unsustainable fishing practices, especially the increased use of drag nets (with ever smaller gaps in the netting), motor boats, and incentives to over fulfill plans.[41] That said, he like almost all Soviet citizens, believed that the natural world was in many respects there for human use, but that one needed to use the gifts of nature wisely and in such a way that would ensure their continued bounty. While other forms of industrial development might be tolerable, the Grigorovich plan was far more than Kozhov could bear. Grigorovich had sent assistants to Kozhov in the months before the conference to enquire what might happen to the flora and fauna of Baikal if the water level were indeed to drop 5 meters. "I confess," Kozhov said later, "that I didn't pay any attention to the visit—the absurdity of the plan was all too evident" and he went abroad to a conference in Great Britain. Yet, absurd or not, Grigorovich forged ahead with his project, starting a media campaign leading up to the conference.[42] Upon his return from abroad, Kozhov was shocked to find the media barrage. At the request of central planning ministries, who were hoping for Kozhov's stamp of approval, he reviewed the plan officially—and negatively—causing something of a "panic" among Grigorovich's proponents. They lobbied aggressively in Irkutsk and Ulan-Ude and were able to convince many important officials of the rectitude and economic benefit of the plan.[43]

Despite the opposition of Kozhov and many others like him, the Grigorovich plan was allowed onto the conference agenda. Through the hallways and dining rooms of the conference, debates over the Grigorovich project—both in whispers and fist-slamming screaming matches—

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[41] On Kozhov and his work, see Josephson, Kozhova, Kozhov, and EG. On unsustainable fishing practices broadly around the world, see for instance *National Geographic* (2007) and *Mother Jones* (2006).

[42] Grigorovich took particular advantage of radio broadcasts, but also had articles published *in Sovetskaia Rossiia* and *Buriat-Mongol'skaia Pravda*.

[43] Weiner, *Little Corner*, p. 358. See also Zlobin.

could be heard. Then, the next day, in a scene that could not have been better scripted for its pathos, the mild-mannered Kozhov had reached his limit. Asking to speak but not waiting for permission from the chairman, he addressed the assembled scholars, "heatedly, confusedly" attacking Grigorovich's plan.

> I had no intension of addressing you, but I can't remain silent. Forgive my inconsistence, but I haven't prepared any speech. The ichthyologists aren't the only ones who oppose the plan. The economic councils are against it too. Every sober-minded person will be against it. Baikal is Nature's unique gift to us. It is the deepest lake in the world, a real sea, but if its fauna and flora are to survive, it must have its shallow spots. In lowering its level by five meters, we shall dehydrate, so to speak, an off-coast strip of 100,000 hectares, dry all the sediments, all the spawning places. The fish pastures will be destroyed. The coastline will recede by from one to five kilometers. The river estuaries will be denuded, the rivers will form new beds and will rove about the friable silty ground that once formed Baikal's bottom and wash away all of the nourishing silt from the slopes of the reefs. Grigorovich has done some calculating—20,000 million kilowatt-hours, 2,000 million rubles. But the economic councils also know how to count. There will also be 2,000 million rubles' worth of losses. Yes, the ichthyologists are against, and they say so straight. We have no right to ravish the harmony and beauty of this unique gift of Nature's.[44]

[44] Zlobin, p. 87-88.

Despite Kozhov's speech, Grigorovich and his associates remained relatively confident that their plan would be approved and included in the final proposals of the conference. But the tide had turned. Speaker after speaker now attacked Grigorovich's plan, based on considerations of economic feasibility, aesthetic destruction, and its misguided scale. Grigorovich came back a few days later with a revised plan that would reduce the explosion and decrease the drop in water level from 5 meters to 1.5 meters. In such a small drop, he argued, the biologists had nothing to fear. A voice from the audience was heard "Where did you get that? Of course they're afraid, and very much so." Grigorovich attempted to give himself some environmentalist credentials: "I want to declare in front of this auditorium that we, electrical engineers, also love nature just like biologists do. … [Another voice from the audience: "It doesn't look so."] We are not enemies of Baikal. We want Baikal to be used not just for us to admire on, but also so that it gives the country the maximum that it is able to give."[45] But he was increasingly drowned out by voices from the auditorium. Markushev: "No one has given us the right to deprive ourselves of so much fish—up to 20,000 tons a year. That's as much as 200,000 head of cattle. History would not forgive us if we do so." Moiseyev: "In our opinion, the cut in the source of the Angara, envisaged by the report, is a utopia, to say the least." Conference participants voted to reject Grigorovich's plan—and also proposed paper mills—and then create Baikal into a nature preserve (*zapovednik*) for 10-15 km radius around the lake.[46]

There had been efforts before 1958 on the part of Siberian scientists and others to protect Baikal from human threat/tampering. Most notable among these was the Barguzin nature preserve, which, when opened in 1916, was intended to protect the sable stocks that had been hunted virtually into oblivion, and which was one of the first areas in Russia to be set aside

[45] Zlobin, "Na sibirskoi," 134; Zlobin, p. 89.
[46] Zlobin, 88-91.

specifically for nature protection and the first and only one opened by government command before the revolution.[47] After the 1958 conference, however, Lake Baikal became the center of the most powerful environmental movement in the Soviet Union: in response to the absurdity of the Grigorovich plan (and the success in stopping it), and also because of plans to build two massive cellulose combines on Baikal's shores—Baikal'sk and Selenginsk. And, indeed, modern environmentalism in the Soviet Union (and now Russia) is deeply rooted in the environmental movement that was mounted to defend Lake Baikal. Until Chernobyl in 1986, and in many respects even after that too, Baikal was *the* environmental cause of the post-WWII period. Others may have been worse in terms of their impact on the natural world (such as the draining of the Aral Sea or Chernobyl), but none grabbed the Russian imagination more strongly or deeply as Baikal. As the great champion of Baikal, Valentin Rasputin, wrote in 1981: "Long ago [Baikal] became the symbol of our relationship to nature, and now too much depends on whether or not Baikal will remain pure and intact. This would have been not just one more boundary that the human race conquered and crossed but the final boundary: beyond Baikal there would be nothing that could stop people from going too far in their efforts to transform nature."[48]

The Baikal protection movement was not always successful (indeed, far from it) and was far from the coherent group that the label "movement" might indicate. Yet, for the day, it was a most shocking turn of events. In the tightly controlled world of the Soviet Union where—like almost everywhere on the planet at the time—industry (and big, rapid industry) was considered

[47] On Barguzin, see Shtilmark, *History of the Russian Zapovedniks*; Weiner, *Models of Nature* and *A Little Corner of Freedom*; and S. Ustinov, *Zapovednik na Baikale*

[48] Rasputin, "Baikal," in *Siberia on Fire*, 193. See also Sergeev, *The Wonders and Problems of Lake Baikal*, p. 49 for the argument that modern environmentalism in Russia began in Siberia and esp. with the Baikal struggle.

an unqualified good,[49] it was not exactly common to see scientists, writers, and even numerous high-level bureaucrats publicly voicing their opposition to development plans around Baikal. Indeed, many very loyal communists who were generally more than happy to play along with the party line, including the rapid industrial transformation of Siberia, drew the line at Baikal. For instance, Geologist Andrei Trofimuk, a vocal proponent of oil development with little regard for environmental outcomes, became, in the words of one of his colleagues, a "wild animal" in support of keeping Baikal safe.[50] The movement published exposés in the newspapers, calling the government to task for their activities and demanding that Baikal be protected. The debate over Baikal touched a nerve in the population. Each article that appeared in the newspapers in defense of Baikal elicited hundreds, at times thousands, of reader responses—writing into the newspapers to declare their support for Baikal and their disgust and frustration at the activities of the economic planners.[51] Letters in the archives of the Siberian division of the Academy of Science included the following cries for justice and willingness to sacrifice themselves for the sake of the lake. "I am a pensionerka, my pension is not large, but if the government needs revenues from Baikal, I will give 5 rubles every month so that Baikal will remain untouched." [52]

Defenders of Baikal used whatever authority and resources they had at their disposal to lobby government and party officials, hold conferences and meetings to demonstrate the folly of development plans (more than 40 such meetings between 1958 and 1966 alone),[53] and conduct

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[49] For a global view, see 2 works by Paul Josephson, *Industrialized Nature* and *Resources under Regimes*.
[50] Quoted in Josephson, *Akademgorodok*, p. 166.
[51] KP and LG, and Weiner
[52] Vikulov, p. 9. The names were taken out of the published versions of these letters because the people were then deceased.
[53] Weiner, p. 370

extensive research to document environmental destruction to Baikal. So great and powerful was the surge of support in the defense of Baikal, that the government felt the need to defend itself publicly in the press. And we see a public to and fro between government representatives and the Baikal defenders over the fate of Baikal. The defense of Baikal allowed groups to meet, form, and then publicly voice their opinions, criticizing leaders in ways that were in many respects inconceivable in other areas of social and economic life.